Geophysical Research Abstracts, Vol. 7, 10289, 2005
SRef-ID: 1607-7962/gra/EGU05-A-10289

Initial Cassini observations reveal a multi-faceted magnetosphere at Saturn

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The initial approach to Saturn and the first orbits of the Cassini spacecraft around the planet have revealed a multi-faceted magnetosphere, which we will investigate using the full suite of Magnetosphere and Plasmas instruments on board (MAG, CAPS, MIMI, RPWS, CDA, and UVIS) and with the help of the recently-developed MAPS-KP data base.

The approach phase first showed Saturn's magnetosphere as an astrophysical object: we saw it from some distance as a source of photons, radio waves, and even dust streams! This phase was a unique opportunity to evaluate the degree of control of radio and auroral emissions by the solar wind.

As we flew inside the magnetospheric cavity, Saturn's magnetosphere could be explored again 20 years after Voyager. We present the different plasma and fields boundaries detected by the instruments, the regions they separate, and discuss the different chemical and/or dynamical regimes of these regions.

When "zooming in" from outside, we first crossed the outer magnetosphere, which is

dominated by irregular and low-density plasma populations. Inside of about 10 R_S, water ions are present at all energies, in a region where energy distributions suggest on-going radial transport in a region where bulk motions are likely dominated by co-rotation. This “water magnetosphere” is the product of water production and irradiation near the rings and icy satellites.

Finally, the Saturn Orbit Insertion maneuver provided a unique opportunity to cross and explore the “rings magnetosphere”, the region conjugate to the main rings. This region revealed complex signatures of electron acceleration, trapped particle populations and wave emissions which will be discussed in the light of the electro-dynamic coupling of the rings plasma with its tenuous atmosphere, dust population and with the conjugate ionospheres of Saturn.